Date _____

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Q1. Write down the necessary safety precautions to be followed in Machine shop.

Ans: • Importance of safety precautions —

a) To save time and life of the individual.

b) To avoid danger to machinary and to keep up the accuracy of the machine.

c) To avoid the hindrace to co-workers and firms.

d) To support the family dependence

• Before entering the workshop, all are bound to adopt the safety rules strictly to avoid any possible accident occurance. Many accidents occur due to carelessness, when people fail to follow safety rules. Factors of accidents are —

1) Improper dress
2) Fear
3) Poor judgement
4) Lack of interest
5) Ignorance
6) Over-confidence
7) Worries
8) Fatigue
9) Dullness
10) Insufficient knowledge
11) Improper handling of tools
12) Poor physical fitness

• Workshop safety precautions :

a) Keep the workshop clean and tidy.

b) Wear light clothes.

c) Never place shop materials on the floor

d) Don't run, shout, knock inside the machine shop.

e) Store the inflammable material such as oil, grease etc away from the workshop.

f) Ring emergency alarm call in case of accident immediately.

g) Keep the fire bucket and extinguisher ready, remember about the danger of slippery floor

• Personal Safety :

a) Wear tight dress, not loose and torn clothes.

b) Wear fully covered footwear of leather and never wear rubber footwear.

c) Wear goggles and avoid wearing rings and wrist watch while working.

d) Never try to operate machine or a tool which is unfamiliar.

e) Don't attend for cleaning, repairing, adjusting, lubricating while in motion thinking self as a master of the profession.

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f) Check up the parts before starting a machine and never work on unguarded machine.

g) Call for sufficient manpower if a job is heavy.

h) Never apply more load than the capacity of the machine.

i) Call electrician for electrical parts.

j) Never store pointed tools on top of the machine.

k)

- **Machine safety:**

i) Don't start any machine before getting instructions and permission.

ii) Never work on unguarded machine.

iii) Never operate a machine unless its mechanism and working condition is known.

iv) If any machine produce unusual sound than stop it immediately.

v) Never apply more load beyond the capacity of a machine.

vi) For lifting or leading machine, don't use a crowbar resting on the working part.

vii) If any machine is not in working condition, hang a board "Under repair" on it or disconnect the power supply.

viii) The operator should not leave the machine while automatic running i.e. maintenence is also more important to save the machine life.

- **Hand tool safety:** Generally hand tools have sharp points and edges, carelessness and impraper handling can cause accidents.

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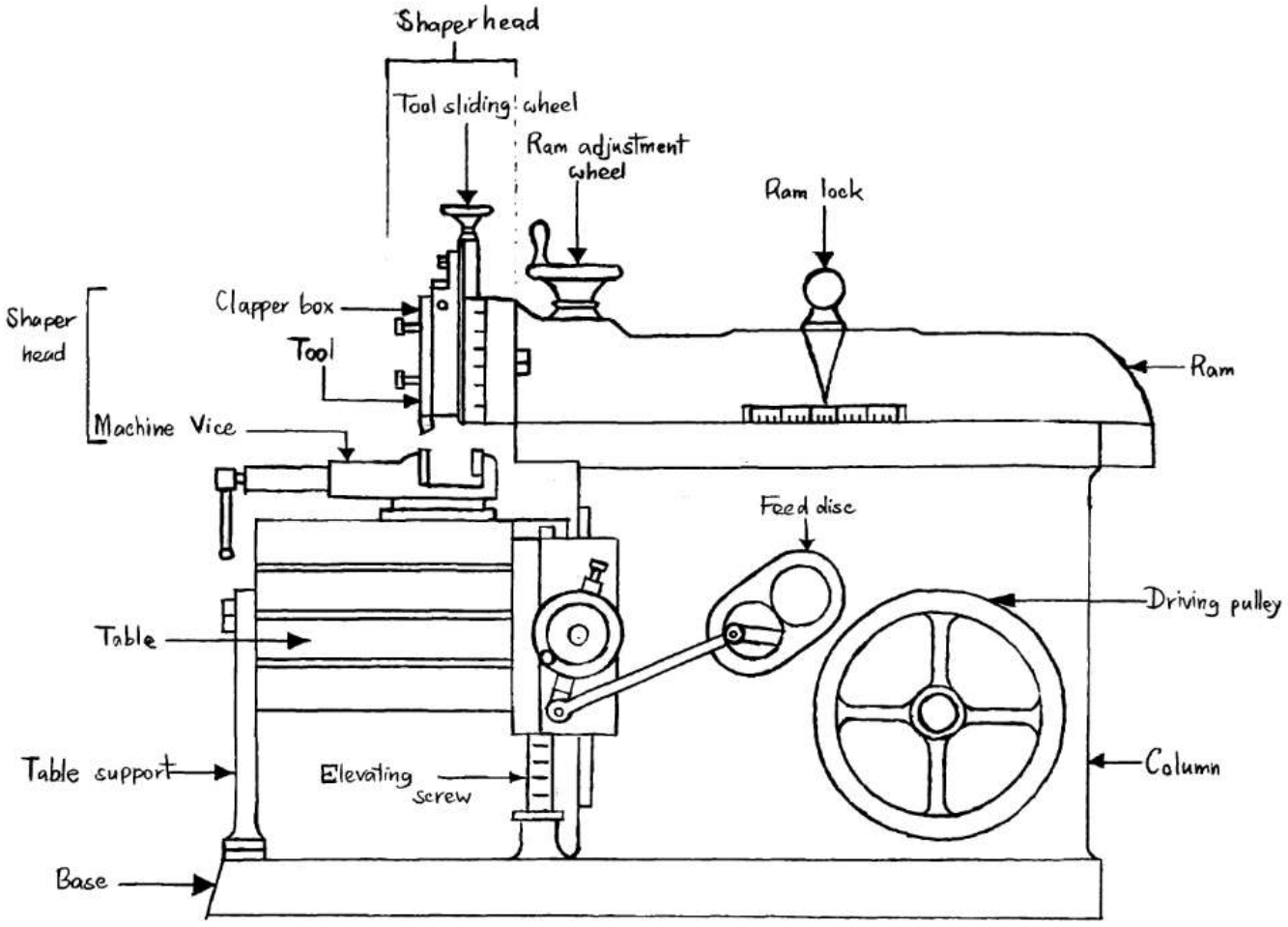
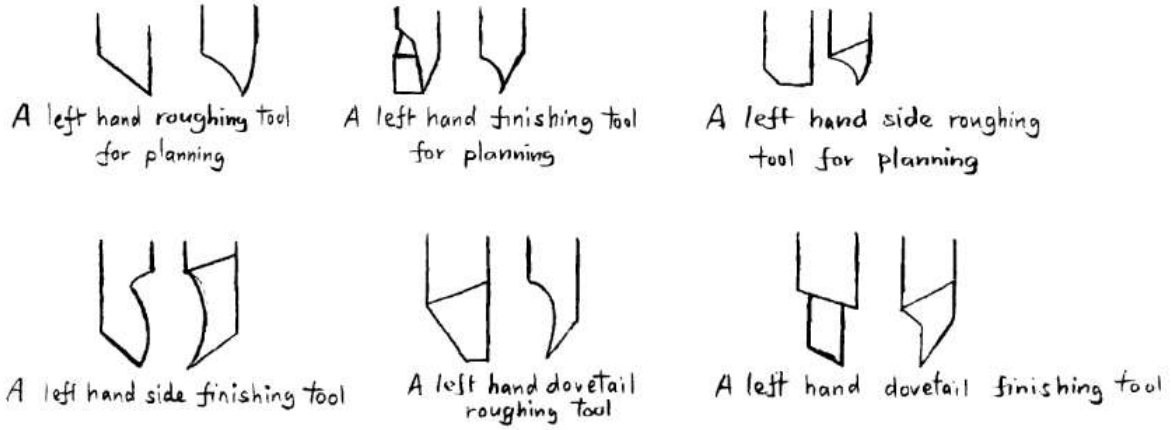


Shaper machine


A left hand roughing tool for planning
A left hand finishing tool for planning
A left hand side roughing tool for planning
A left hand side finishing tool
A left hand dovetail roughing tool
A left hand dovetail finishing tool

Cutting tools used in Shaper machine

Date _____

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- Q. Write down the main and subordinate parts of a shaper machine.

Ans: The main and subordinate parts of a shaper machine —

1] Base	5] Cross rail	9] Table	13] Apron
2] Column	6] Tool head	10] Shaper head	14] Sadder
3] Ram	7] Shaper tool	11] Driving pulley	15] Crank block
4] Ram lock	8] Vice	12] Clapper box	16] Bull gear

- Q. Write down the functions of parts of a shaper machine.

Ans: Functions of different parts of a shaper machine —

a] Shaper head: It is a separate unit including the tools head, which is fixed in front of the ram face. It consists of several parts such as gradually swivelling lead with vertically fixed rod. Clapper box is also fitted with block linkage with pin tools held onit. It can turn 90° in both directions for fitting the cutting or shaping tool either vertically or various directed angles.

b] Bull gear: It is the largest strong gear fitted with a pin mounted inside the column of the machine on a shaft, bolted to the centre of the pin called crank pin. Rotation of the bull gear causes the crank pin to revolve in uniform speed, which leads to the reciprocating of rocker arm. Thus the bull gear converts rotary motion to reciprocating motion of the ram.

c] Tool head: It is attached to the front of the ram with nut and bolt to hold the tool rigidly. It also provides the vertical and angular movement to the tool for cutting.

d] Ram lock: It is a strong, rigid, hollow casting seated over the top of the column to reciprocate by means of the pocket and crank effect. It carries the tool head in front which consist of the cutting tool fixed onit. A lever is fixed either on top or the back of the ram for positioning the ram.

e] Clapper box: It is a box to support the clapper block link by a pin on the tool head It allows the firm dragging of the tool during cutting stroke and slight raise from the working material during return stroke by the hinged system, assuring the safe movement of the cutting tool over the work.

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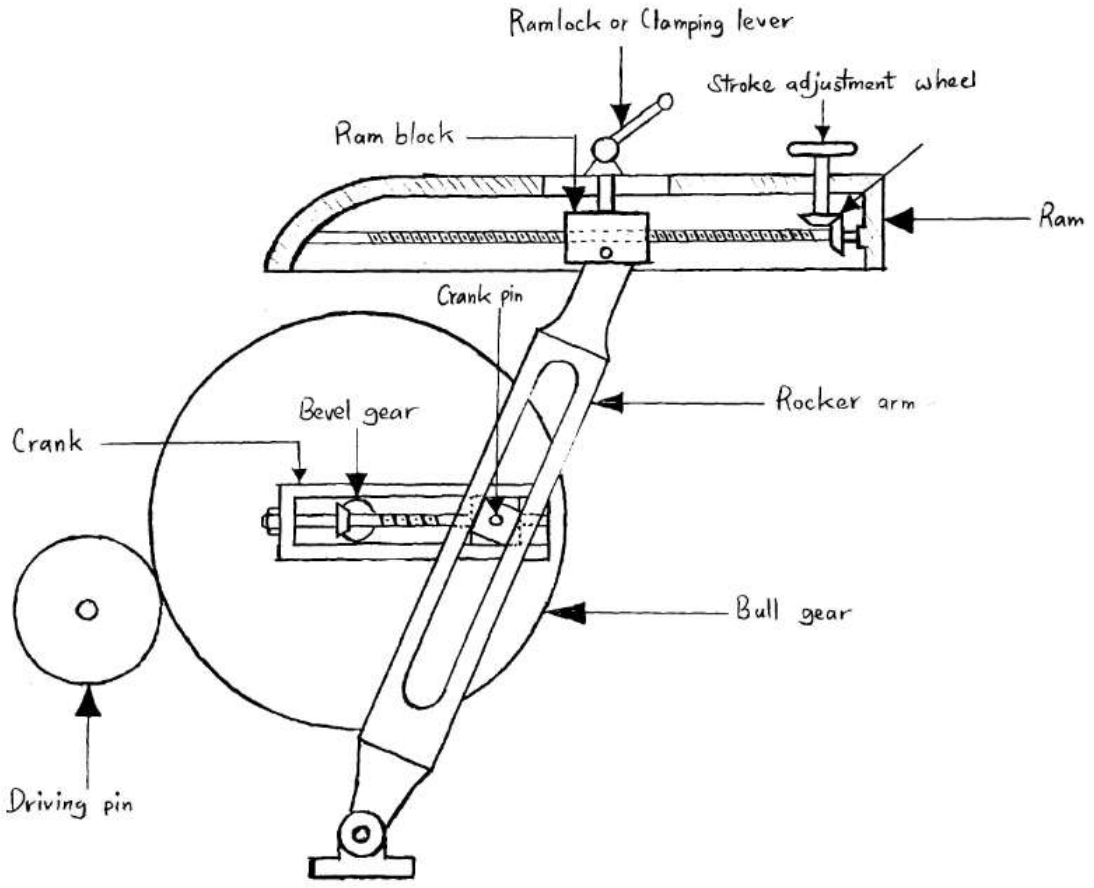

Crank mechanism

f] Apron: It is clamped upon the vertical slide of the tool head by a screw, consisting of a copper clapper block. By releasing the clamped screw, the apron swivels upon the pin either towards left or right with respect to the vertical slide. It provides relief to the tool while dragging vertical or angular cuts.

- Q. Write down the functions of shaper machine.

Ans: The shaper machine is a versatile machine primarily designed to generate flat surface by a single point or groove cutting tool. Different operations which surface flattening includes

1] Machining horizontal surface
2] Machining vertical surface
3] Machining angular surface
4] Machining irregular surface to regular
5] Cutting short grooves and keyways
6] Cutting splines or cutting gears

- Q. Describe slider crank mechanism with diagram.

Ans: The slider crank mechanism is used to co-ordinate or convert the rotatory motion of the bull gear to reciprocating motion of the ram. The motion or power is transmitted to the bull gear first, through a driving pin which receives it rotation from an individual motor. Speed of the bull gear may be hinged by different combination of gear or by simply shifting the bolt one step by pulley. Bull gear is the large gear mounted within the column. A radial slide called bull gear sliders bolted to the centre of the bull gear, carrying a slide block into which the crank pin is fitted. Rotation of the bull gear causes the crank pin to rotate about the crank pin circle. At the same time the slot moves up and down in the slotted link giving it a racking movement which is transmitted to the ram.

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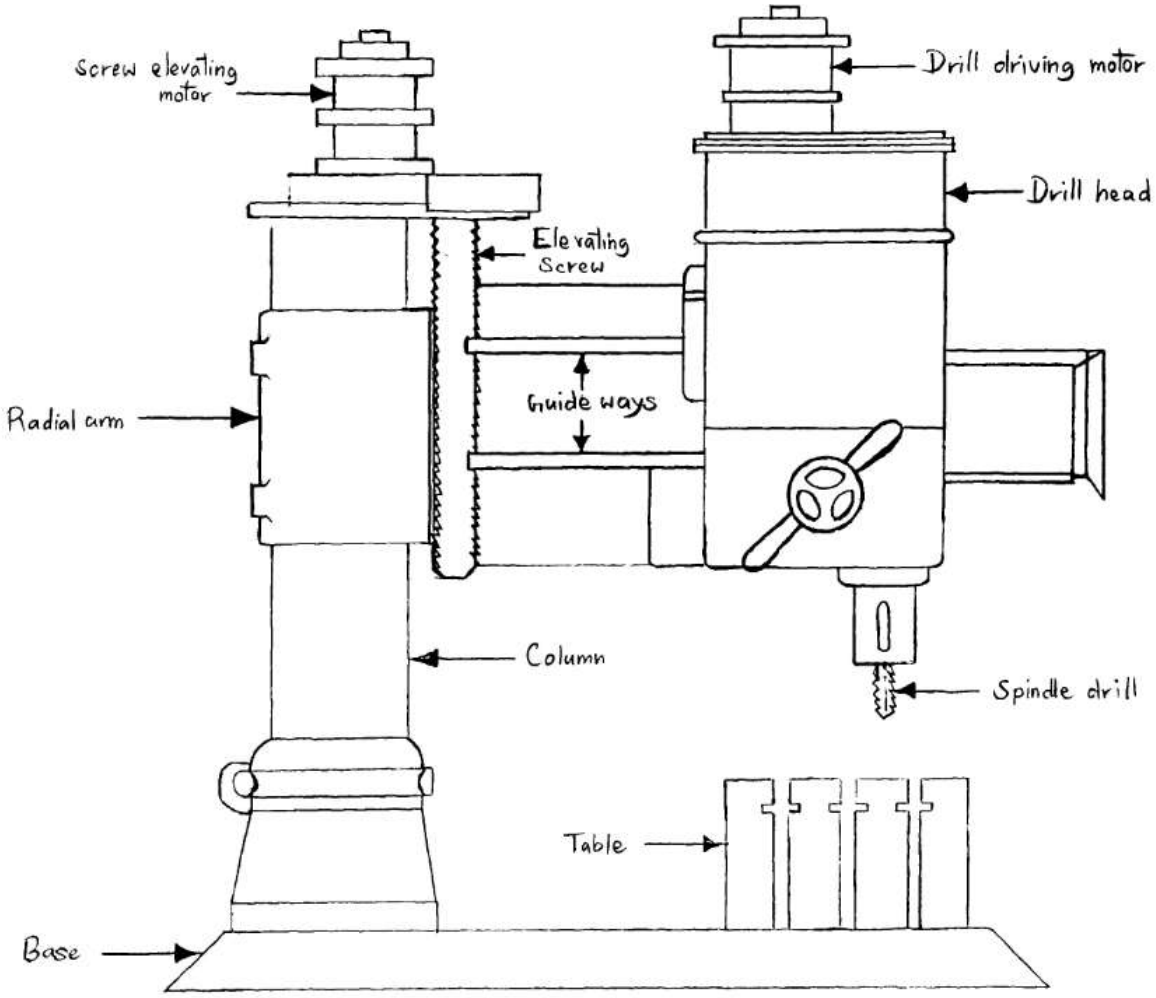

Radial Drilling machine

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• Q. Write down the functions of drilling machine.

Ans: Drilling machine is one of the most important machine tool in the machine shop. This machine is primarily designed to generate holes in the job material, but it can perform a number of similar operations. A drilling machine can drill quickly and at a low cost. The different operations that can be performed in a drilling machine are —

i) Drilling
ii) Reaming
iii) Boring
iv) Counter sinking
v) Counter boring
vi) Spot facing
vii) Tapping
viii) Grinding
ix) Trepanning
x) Lapping

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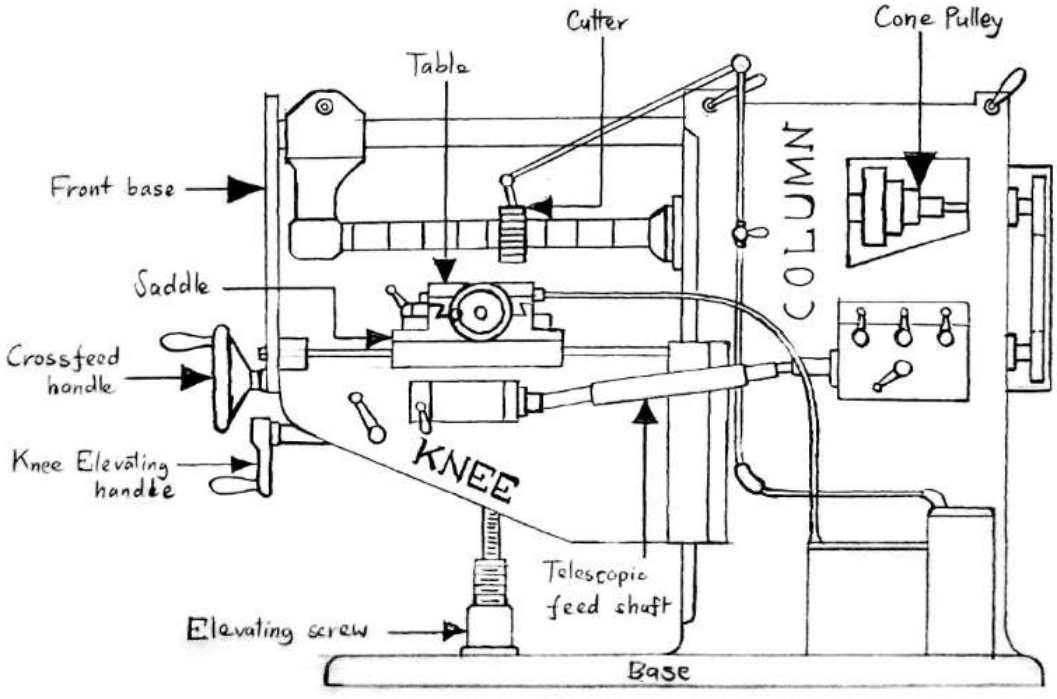

Column & Knee type Milling machine

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Q. Write down the specifications of a (a) Shaper machine
(b) Drilling machine
(c) Milling machine

Ans: a) Shaper machine: The size of shaper machine is determined by the maximum length of stroke which is 50 mm and it holds and shape a cube or block of maximum 50 mm of one side at least. Specification of a shaper machine —

i) Maximum stroke length of ram
ii) Maximum length of tool travel is vertical
iii) Table or saddle travel in vertical
iv) Strokes per minute
v) Working surface of table top
vi) Table or saddle travel in vertical

b) Drilling machine: The specification of a drilling machine varies with its types. A portable drilling machine is specified by a maximum diameter of the drill that it can hold. Sensitive and upright drilling machine are specified by the diameter of the largest piece that can be spindled under the drill bit. Thus, in the case of 600 mm size upright drilling machine, the spindle plane at a distance is slightly greater than 300 mm from the front. To specify a drilling machine fully, further particulars such as maximum size of operable drive, table diameter maximum for a spindle, power input, floor space, required weight of the machine etc all are considered. The size of the radial drilling machine is specified by the diameter of the column and length of the arm. Others particulars such as maximum drilling radius, minimum drilling radius, spindle speed and feed etc should also be stated about a drilling machine.

c) Milling machine: A milling machine is a machine tool that removes metal as the mark is put against a rotating multipoint cutter. The cutter rotates at high speed with multiple cutting edges removing metal at a fast rate, making it superior to other machine & tools in case of accuracy & better surface finishing. It's types are — ⟨i⟩ Column & knee type ⟨ii⟩ Manufacturing of fixed bed type ⟨iii⟩ Planner type ⟨iv⟩ Special type

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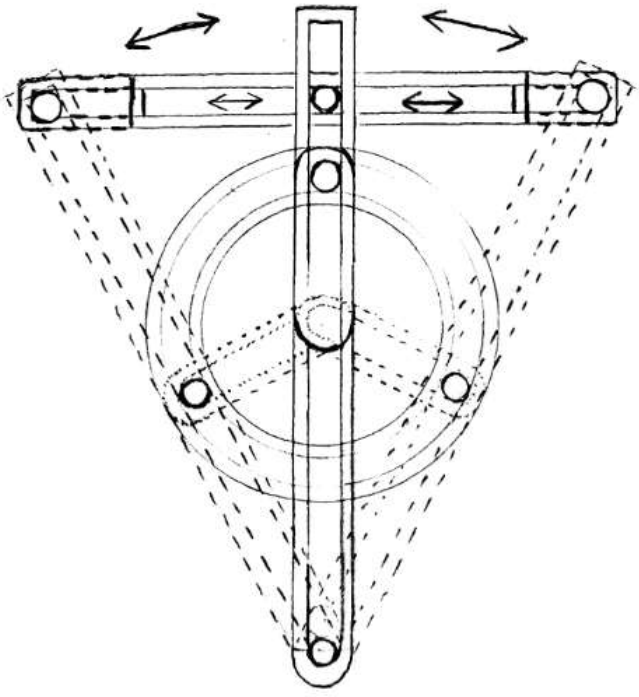

Quick Return Motion Mechanism

• Short Notes:

* Cutting speed of a shaper machine: In a shaper machine the rate at which the metal is removed by the cutting tool, is known as cutting speed of the shaper, which is expressed in metre/minute. In a shaper, cutting action is intermittent and speed is only considered during the forward stroke. The speed of a shaper can be calculated from the following formula:

$$\text{Speed of the shaper} = \frac{\text{Length of the cutting shape}}{\text{Time required by the cutting stroke}}$$

* Feed: Feed is the relative movement of the ram/double stroke, expressed as the tool or work in a direction perpendicular to the axis of reciprocation of the ram/double stroke. When the tool is not cutting the metal, the selection upon which the feed is dependent are-

i) Nature of finishing
ii) Shape of the tool
iii) Depth of cut
iv) Rigidity of the job
v) Capacity of the machine

* Depth of cut: The depth of cut is the thickness of the metal chips that is removed in one stroke or cut. It is the perpendicular distance measured between machined surface and non-machined surface of the work piece. It is important to the tool not to run over the surface skin, otherwise the cutting edge of the tool may be damaged. The depth of cut may vary from 0.8 mm to 4.8 mm.

* Quick Return motion mechanism: The quick return action is made mechanically by means of crank and stroked link. The speed of the machine depends upon the rotation of the bull gear. One of the rocker arm is fixed on the pital centre. The rocker arm is made to rock back ward the crank pin which is fixed to the bull gear moving in circular path. Operation of the rocker arm is through the sliding block which travels up and down in the slap of the rocker arm to the ram for connecting and as a cillating motion or reciprocating motion.

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Assignment : Give a certain depth of cut to a MS plate and calculate the volume of removed metal and machining time.

Answer: If Given, Let, L = Length of the stroke in mm.

B = Breadth of the work in mm.

s = The feed expressed in mm/double stroke.

m = The ratio of return time to cutting time

v = The cutting speed in mm per unit

$\therefore$ Time taken to complete one double stroke $= \frac{L}{1000 \times v}(1+m)$

Total no. of double stroke required to complete the job $= \frac{B}{s}$

$\therefore$ Volume of removed metal = (Volume of the non machined work) − (Volume of the work after machining)

Total time taken to complete the cut $= \frac{L \times B(1+m)}{1000 \times v \times s}$

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